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(71)Applicant : TOYO COMMUN EQUIP CO LTD  
FUKUSHIMA TOYO TSUSHINKI KK

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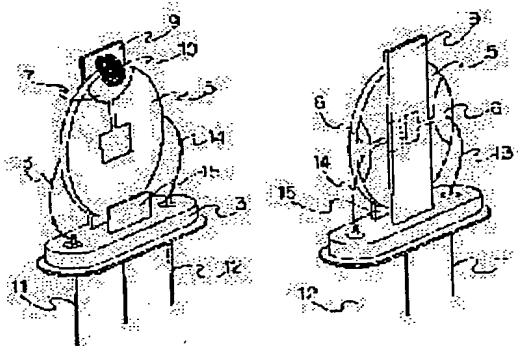
(72)Inventor : WATANABE JUN

## (54) SUPPORT STRUCTURE FOR PIEZOELECTRIC DEVICE

## (57)Abstract:

**PURPOSE:** To facilitate the assembly of a piezoelectric element onto a stem, to restrict the effect of distortion from the stem and to obtain a support structure with an excellent shock resistance by fixing a support plate and an upper ridge of a piezoelectric plate with an adhesives, supporting them so as to suspend the piezoelectric element and connecting an electrode pad formed to the piezoelectric plate and a lead terminal arranged to the step with a wire.

**CONSTITUTION:** A support plate 9 is stood upright almost in the middle of a stem 3 so as to be in parallel with a major surface of a crystal plate 5 to be supported, an upper ridge of the crystal plate 5 is adhered and fixed to the plate support 9 with an adhesives 10 and they are supported to be suspended. Then the electric wiring is implemented by connecting lead terminals 11, 12 penetrated air-tightly to the stem 3 and insulated electrically to the stem 3 to electrode pads 6, 6 of the crystal plate 5 with wires 13, 14 respectively. When the crystal plate 5 is mounted on the stem 3, it is implemented by having only to adhere the upper ridge of the plate 5 to the support plate 9 and automatic mounting is comparatively and easily implemented.



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CLAIMS

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[Claim(s)]

[Claim 1] Maintenance structure of the piezo-electric device characterized by connecting with a wire the electrode pad formed in the piezo-electric blank while supporting so that the tabular support and the upper-limit marginal part of a piezo-electric blank which were set up on the stem might be fixed with adhesives and the pendant of the aforementioned piezo-electric blank might be carried out, and the lead terminal arranged in the stem.

[Claim 2] Maintenance structure of the piezo-electric device according to claim 1 characterized by having made it flow through a tabular support with the grounding terminal of a stem while forming the ground electrode and the electrode pad which flowed in the upper-limit marginal part of a piezo-electric blank, and fixing the aforementioned upper-limit marginal part and a tabular support in an electroconductive glue.

[Claim 3] The claim 1 characterized by having \*(ed) the aforementioned tabular support and the predetermined gap and setting up a stopper on a stem that deformation of a piezo-electric blank should be prevented, or maintenance structure of a piezo-electric device given in two.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the maintenance structure of the piezo-electric device like a piezoelectric transducer or a piezo-electric filter.

[0002]

[Description of the Prior Art] There is \*\*\*\*\* shown in drawing 3 (a) and (b) as structure of holding the double mode crystal filter using thickness skid vibration of a piezo-electric device, for example, AT-cut crystal. While the composition of this mounting \*\* a predetermined gap and sets it up on a stem 3 so that phase opposite of the tabular lead terminals 2 and 2 which have the two springs nature in which the slit 1 was formed may be carried out mutually. The comparatively short lead terminal 4 between the aforementioned tabular lead terminal 2 of this stem 3 and 2 is mostly formed in the center. In one main front face of the crystal blank 5, two electrode pads 6 and 6 which flow with an I/O electrode in the center and flow with these at a blank marginal part mostly, respectively. While inserting in the slits 1 and 1 of the aforementioned tabular lead terminals 2 and 2 the blank marginal part which has the electrode pads 6 and 6 of the double mode crystal filter which formed in the field of another side the electrode pad 7 which flows with a ground electrode in the center and flows with this at a blank marginal part mostly by vacuum evaporation etc., respectively, respectively. It was common to have made the crystal blank 5 arrange so that the electrode pad 7 may contact the aforementioned lead terminal 4, and to have pasted up between each electrode pad and lead terminals by the electroconductive glue 8 that flow fixation should be carried out.

[0003] However, when [ at which this is not contained in a case (not shown) like drawing 4 (a) depending on how to apply the force to the crystal blank 5 that lead terminals 2 and 2 should deform and this crystal device should be closed in case the crystal blank 5 is incorporated on a stem 3 in the crystal device which applied the maintenance structure like \*\*\*\* ] carrying out, the fault that this case and the crystal blank 5 collide arises. Furthermore, automatic mounting or automatic adhesion by the machine was difficult for this structure, and since the place still depended on a handicraft was large, it had become the obstacle of a cost cut. When the aforementioned tabular lead terminals 2 and 2 were replaced with the rigid high thing that this should be solved, although deformation of this lead terminal could be prevented, when closing it by welding a stem 3 and a case by resistance, distortion of the stem 3 produced by welding tended to transmit it to the crystal blank 5 through lead terminals 2 and 2, and it had the defect in which the center frequency of a double mode crystal filter was changed.

[0004] Furthermore, for are as in inverse-proportion [ the resonance frequency / to the board thickness of a blank ]-in thickness skid vibration common knowledge and obtaining a RF, you have to make board thickness of a blank thin. By having made board thickness of a blank thin with the demand of RF-izing to the oscillating device of these days, also in the comparatively small shock, breakage of a blank came to be conspicuous, and as especially shown in drawing 4 (b), the defect in which it was easy to damage in a V predicted to be cause character type configuration also had generating of the complicated stress by torsion of the aforementioned tabular lead terminals 2 and 2.

[0005]

[Objects of the Invention] this invention is made in order to remove the defect of the maintenance structure of the piezo-electric device of the \*\*\*\* former mentioned above,

inclusion of the piezo-electric blank to a stem top is easy for it, the limit of the influence of distortion from a stem is carried out, and it aims at offering the maintenance structure of the piezo-electric device excellent in shock resistance.

[0006]

[Summary of the Invention] The maintenance structure of the piezo-electric device which starts this invention in order to attain the above-mentioned purpose The tabular support and the upper-limit marginal part of a piezo-electric blank which were mostly set up in the center on the stem are fixed with adhesives. The electrode pad formed in the piezo-electric blank while supporting so that the pendant of the aforementioned piezo-electric blank might be carried out, and the lead terminal arranged in the stem are connected with a wire. Furthermore, while forming an electrode pad in the upper-limit marginal part of a piezo-electric blank, or it fixes this electrode pad section and a tabular support in an electroconductive glue, deformation of a piezo-electric blank is restricted, that breakage should be prevented, on a stem, the aforementioned tabular support and a predetermined gap are \*(ed) and a stopper is set up.

[0007]

[Example] Hereafter, this invention is explained in detail based on the drawing in which an example is shown. Drawing 1 (a) and (b) are the perspective diagrams from the front face which shows the example of the maintenance structure of the double mode crystal filter concerning this invention, and a tooth back, respectively. While setting up so that it may become parallel to the main front face of the crystal blank 5 which uses as a maintenance plug the tabular support 9 which consists of a material of a stem 3 almost comparatively \*\*\*\* to a center, it holds so that adhesion fixation of the upper-limit marginal part of the crystal blank 5 may be carried out with adhesives 10 and the pendant of this may be carried out to this tabular support 9. What is necessary is here, to have flowed through the tabular support 9 electrically with the grounding terminal of a stem 3, and just to set it up so that it may flow with a direct stem since it generally considers a stem main part as a ground. It \* and the electroconductive glue is used as adhesives 10 to make it flow through this and the electrode pad 7 located in the upper-limit marginal part of the crystal blank 5. Furthermore, airtight penetration of the stem 3 is carried out, and electric wiring is performed by connecting the lead terminals 11 and 12 electrically insulated with this, and the electrode pads 6 and 6 on the crystal blank 5 with wires 13 and 14, respectively. In addition, at this time, although connection of a wire may use what technique, probably, connecting in the so-called wirebonding will be common. Moreover, a gap the aforementioned tabular support 9 and the crystal blank 5, and respectively predetermined is \*(ed), and the stopper 15 comparatively for the low impact absorptions of the back is set up.

[0008] Thus, when equipping with the crystal blank 5 on a stem 3 by having constituted, the work referred to as inserting the two edge sections of a crystal blank into two slits of a tabular lead terminal like the former that what is necessary is just to paste up the upper-limit marginal part of a blank 5 on the tabular support 9 could be omitted, and automatic mounting-ization also became comparatively easy. Furthermore, as shown in drawing 2 (a) in the usual state, the crystal blank 5 will \* the tabular support 9 and an about 0.1mm gap by the electroconductive glue 10, and it will be fixed only at the upper-limit marginal part. Since distortion produced in a stem 3 stops almost influencing the crystal blank 5 since it becomes the cantilever structure which fixes one upper-limit marginal part of the crystal blank 5 substantially in case a case and a stem 3 are closed by resistance welding, The deflection of the center frequency of the double mode crystal filter before and behind closure will become very minute. Moreover, by having considered as simple cantilever structure, even if it was hard coming to generate the complicated stress produced in the crystal blank by the ability twisting two conventional tabular lead terminals and the board thickness of a crystal blank was thin, it was lost that V character type breakage is observed. As moreover shown in drawing 2 (b), when the shock of the direction shown by the arrow G in drawing joins the maintenance structure of this invention, deformation of the crystal blank 5 is restricted when the soffit marginal part and stopper 15 contact, similarly, in the case of the shock of an opposite direction, the tabular support 9 acts as a stopper and breakage of the crystal blank 5

is prevented. If the crystal blank 5 is held so that the relative side of the I/O electrode side may be carried out to the tabular support 9 like drawing 1, an I/O electrode and the grounding terminal slack tabular support 9 can approach extremely, and can raise the guarantee magnitude of attenuation of a filter conventionally. On the other hand, although mounting of the exclusive use from which the position or width of face of the interval of two tabular lead terminals and a slit differs with the configuration of a crystal blank in the conventional maintenance structure had to be prepared, it is possible to hold and carry out electric wiring of the crystal blank, without the maintenance structure concerning this invention taking an exceptional process, even if the configuration is circular and it is a rectangle, if the dimension of a crystal blank does not exceed the size of a stem.

[0009] you may be, the piezo-electric devices, for example, the vibrator, other than the multiplex-mode piezo-electricity filter which can apply this invention also to piezo-electric devices other than crystal above although the double mode crystal filter has been explained as an example, and uses the further multiplex mode, or a filter, -- it is clear Furthermore, all electric wiring may be performed for a tabular support with a wire only as a maintenance function, and an electrode pad is prepared in portions other than the upper-limit marginal part of a piezo-electric blank at this time, and it does not matter between this upper-limit marginal part and a tabular support even if it pastes up with the adhesives of non-conducting. Moreover, a stopper does not necessarily need to be the thing of a tabular, and as long as he sets up on a stem so that the soffit marginal part may contact when a piezo-electric blank deforms, he may be a mere cylindrical thing.

[0010]

[Effect of the Invention] this invention realizes the shock resistance which is excellent while having carried out the limit of the frequency deviation before and behind closure by having considered as cantilever structure even if [ when make automation possible and reducing assembly cost, since it constitutes as explained above, and wearing of the piezo-electric blank to a stem becomes very simple and easy, and ] it was the thin piezo-electric blank of board thickness, and when raising the versatility of the stem to the configuration of a piezo-electric blank, it does a remarkable effect so.

[0011]

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] (a) And (b) is a perspective diagram from the front face which shows the example of the maintenance structure of the double mode crystal filter concerning this invention, and a tooth back, respectively.

[Drawing 2] (a) And (b) is drawing explaining the shock resistance of the maintenance structure of the piezo-electric device concerning this invention.

[Drawing 3] (a) And (b) is the front view and the side elevation showing the maintenance structure of the conventional double mode crystal filter, respectively.

[Drawing 4] (a) And (b) is drawing explaining the fault which the maintenance structure of the conventional double mode crystal filter has, respectively.

[Description of Notations]

3 ... Stem

5 ... Crystal blank

6 ... Electrode pad

7 ... Ground electrode pad

9 ... Tabular support

10 ... Electroconductive glue

11 12 ... Lead terminal

13 14 ... Wire

15 ... Stopper

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(71)出願人 000003104

東洋通信機株式会社

神奈川県高座郡寒川町小谷 2 丁目 1 番 1 号

(71)出願人 592057798

福島東洋通信機株式会社

福島県伊達郡保原町字東野崎60番地

(72)発明者 渡辺 潤

福島県伊達郡保原町字東野崎60番地 福島

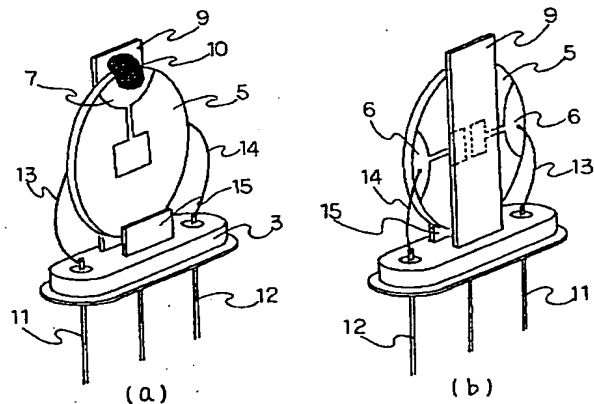
東洋通信機株式会社内

(54)【発明の名称】 圧電デバイスの保持構造

(57)【要約】

【目的】 ステム上への圧電素板の組み込みが容易で、ステムからの歪みの影響を極限し、耐衝撃性に優れた圧電デバイスの保持構造を提供することを目的とする。

【構成】 ステム 3 上ほぼ中央に立設した板状サポート 9 と圧電素板 5 の上端縁部とを接着剤にて固定し、前記圧電素板 5 を吊下する如く支持すると共に圧電素板 5 に形成した電極パッド 6、6 とステム 3 に配設されたリード端子 11、12 とをワイヤ 13、14 にて接続したものである。



## 【特許請求の範囲】

【請求項1】 ステム上に立設した板状サポートと圧電素板の上端縁部とを接着剤にて固定し前記圧電素板を吊下する如く支持すると共に圧電素板に形成した電極パッドとステムに配設されたリード端子とをワイヤにて接続したことを特徴とする圧電デバイスの保持構造。

【請求項2】 圧電素板の上端縁部にアース電極と導通した電極パッドを形成すると共に板状サポートをステムのアース端子と導通せしめ、前記上端縁部と板状サポートとを導電性接着剤にて固定したことを特徴とする請求項1記載の圧電デバイスの保持構造。

【請求項3】 圧電素板の変形を阻止すべくステム上に前記板状サポートと所定の間隙を隔してストッパーを立設したことを特徴とする請求項1 或いは2記載の圧電デバイスの保持構造。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】 本発明は圧電振動子或いは圧電フィルタの如き圧電デバイスの保持構造に関する。

## 【0002】

【従来の技術】 圧電デバイス例えばATカット水晶の厚みすべり振動を利用した2重モード水晶フィルタを保持する構造としては図3(a)、(b)に示す如きものがある。このマウントの構成は、スリット1を形成した2本のばね性を有する板状リード端子2、2を互いに相対向するよう所定の間隙を隔してステム3上に立設すると共に、該ステム3の前記板状リード端子2、2間のほぼ中央に比較的短いリード端子4を設けたものであり、水晶素板5の一方の主表面にはほぼ中央に入出力電極、素板縁部にこれらと夫々導通する2つの電極パッド6、6を、他方の面にはほぼ中央にアース電極、素板縁部にこれと導通する電極パッド7を夫々蒸着等によって形成した2重モード水晶フィルタの電極パッド6、6を有する素板縁部を夫々前記板状リード端子2、2のスリット1、1に挿入すると共に、電極パッド7が前記リード端子4に当接するよう水晶素板5を配置せしめ、各電極パッドとリード端子との間を導通固定すべく導電性接着剤8にて接着するのが一般的であった。

【0003】 しかしながら、上述の如き保持構造を適用した水晶デバイスに於いては、水晶素板5をステム3上に組み込む際、水晶素板5への力の加え方によっては図4(a)の如くリード端子2、2が変形し、この水晶デバイスを封止すべくこれをケース(図示しない)に収納せんとするとき、該ケースと水晶素板5が衝突するという不具合が生じる。更に、この構造は機械による自動マウント或いは自動接着が困難であり、未だ手作業によるところが大きいコストダウンの障害となっていた。これを解決すべく前記板状リード端子2、2を剛性の高いものに代えると、該リード端子の変形は防止できるものの、ステム3とケースとを抵抗溶接することによって封

止する際、溶接によって生ずるステム3の歪みがリード端子2、2を介して水晶素板5に伝達し易く、2重モード水晶フィルタの中心周波数が変動するという欠陥があった。

【0004】 更に、厚みすべり振動に於いてはその共振周波数が素板の板厚に反比例すること周知の通りであり、高周波を得るには素板の板厚を薄くしなければならない。昨今の振動デバイスへの高周波化の要求に伴い素板の板厚を薄くしたことにより比較的小さい衝撃に於いても素板の破損が目立つようになり、殊に図4(b)に示す如く、前記板状リード端子2、2のねじれによる複雑な応力の発生が原因と予測されるV字型の形状で破損し易いという欠陥もあった。

## 【0005】

【発明の目的】 本発明は上述した如き従来の圧電デバイスの保持構造の欠陥を除去するためになされたものであって、ステム上への圧電素板の組み込みが容易で、ステムからの歪みの影響を極限し、耐衝撃性に優れた圧電デバイスの保持構造を提供することを目的とする。

## 【0006】

【発明の概要】 上述の目的を達成するため本発明に係る圧電デバイスの保持構造は、ステム上ほぼ中央に立設した板状サポートと圧電素板の上端縁部とを接着剤にて固定し、前記圧電素板を吊下する如く支持すると共に圧電素板に形成した電極パッドとステムに配設されたリード端子とをワイヤにて接続したものであって、更に圧電素板の上端縁部に電極パッドを形成すると共に該電極パッド部と板状サポートとを導電性接着剤にて固定する或いは圧電素板の変形を制限し破損を阻止すべくステム上に前記板状サポートと所定の間隙を隔してストッパーを立設したものである。

## 【0007】

【実施例】 以下、本発明を実施例を示す図面に基づいて詳細に説明する。図1(a)及び(b)は夫々本発明に係る2重モード水晶フィルタの保持構造の実施例を示す前面及び背面からの斜視図であって、ステム3のほぼ中央に比較的剛な材料から成る板状サポート9を、保持せんとする水晶素板5の主表面と平行となるよう立設すると共に該板状サポート9に水晶素板5の上端縁部を接着剤10にて接着固定してこれを吊下する如く保持するものである。ここで、板状サポート9はステム3のアース端子と電氣的に導通しており、一般にステム本体をアースとするから直接ステムと導通するよう立設すればよい。而して、これと水晶素板5の上端縁部に位置する電極パッド7とを導通させるべく接着剤10として導電性接着剤を用いている。更に、ステム3を気密貫通し且つこれと電氣的に絶縁されたリード端子11、12と水晶素板5上の電極パッド6、6とを夫々ワイヤ13、14にて接続することによって電氣的配線を行う。尚、このときワイヤの結線はいかなる手法を用いてもよいが所謂

ワイヤボンディングにて結線するのが一般的であろう。又、前記板状サポート 9 及び水晶素板 5 と夫々所定の間隙を隔して比較的背の低い衝撃吸収用のストッパー 15 を立設する。

【0008】このように構成したことによって、水晶素板 5 をステム 3 上に装着する際、素板 5 の上端縁部を板状サポート 9 に接着するだけでよく、従来の如く 2 本の板状リード端子のスリット内に水晶素板の 2 ケ所の端縁部を挿入すると云った作業が省略でき、自動マウント化も比較的容易となった。更に、通常の状態では図 2

(a) に示す如く水晶素板 5 は導電性接着剤 10 により板状サポート 9 と 0.1 mm 程度の間隙を隔してその上端縁部のみにて固定されることとなり、実質的には水晶素板 5 の上端縁部 1 ケ所のみを固定する片持ち梁構造となるから、ケースとステム 3 とを抵抗溶接にて封止する際、ステム 3 に生ずる歪みが水晶素板 5 に殆ど影響しなくなるため、封止前後に於ける 2 重モード水晶フィルタの中心周波数の偏差が極めて微小なものとなる。又、単純な片持ち梁構造としたことにより、従来の 2 本の板状リード端子がねじれることによって水晶素板に生じていた複雑な応力が発生しにくくなり、水晶素板の板厚が薄いものであっても V 字型の破損が観察されることがなくなった。その上、図 2 (b) に示す如く本発明の保持構造に図中の矢印 G で示す方向の衝撃が加わったとき、水晶素板 5 の変形は、その下端縁部とストッパー 15 とが当接することにより制限され、同様に逆方向の衝撃の場合は板状サポート 9 がストッパーとして作用して水晶素板 5 の破損を防止する。図 1 の如く入出力電極側を板状サポート 9 と相対面するよう水晶素板 5 を保持すると、入出力電極とアース端子たる板状サポート 9 が極めて近接することとなり、フィルタの保証減衰量を従来より向上させることができる。一方、従来の保持構造に於いては水晶素板の形状によって 2 本の板状リード端子の間隔、スリットの位置或いは幅が異なる専用のマウントを用意しなければならなかったが、本発明に係る保持構造では、水晶素板の外形寸法がステムの寸法を越えないものであれば、その形状が円形であっても矩形であっても格別の工程を要することなく水晶素板を保持し電氣的配線することが可能である。

【0009】以上本発明を、2 重モード水晶フィルタを例として説明してきたが、水晶以外の圧電デバイスにも

適用可能であり、さらに多重のモードを利用する多重モード圧電フィルタ或いはフィルタ以外の圧電デバイス例えば振動子であってもよいこと明白である。更に、板状サポートを保持機能のみとして電氣的配線をすべてワイヤにて行ってもよく、このとき圧電素板の上端縁部以外の部分に電極パッドを設け、該上端縁部と板状サポート間は非導電性の接着剤にて接着しても構わない。又、ストッパーは必ずしも板状のものである必要はなく、圧電素板が変形したときに、その下端縁部が当接するようステム上に立設したものであれば単なる棒状のものであってもよい。

#### 【0010】

【発明の効果】本発明は、以上説明した如く構成するものであるから、ステムへの圧電素板の装着が極めて単純で容易となるため自動化を可能とし組み立てコストを低減する上で、また片持ち梁構造としたことにより封止前後の周波数偏差を極限すると共に板厚の薄い圧電素板であっても優れた耐衝撃性を実現し、圧電素板の形状に対するステムの汎用性を向上させる上で著しい効果を奏する。

#### 【0011】

##### 【図面の簡単な説明】

【図 1】 (a) 及び (b) は夫々本発明に係る 2 重モード水晶フィルタの保持構造の実施例を示す前面及び背面からの斜視図。

【図 2】 (a) 及び (b) は本発明に係る圧電デバイスの保持構造の耐衝撃性を説明する図。

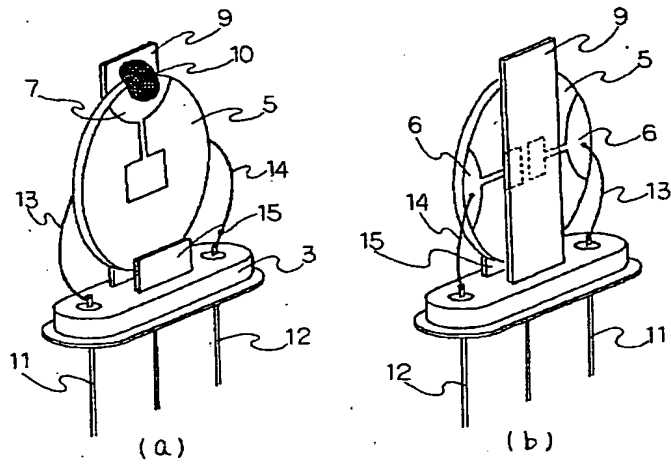
【図 3】 (a) 及び (b) は夫々従来の 2 重モード水晶フィルタの保持構造を示す正面図及び側面図。

【図 4】 (a) 及び (b) は夫々従来の 2 重モード水晶フィルタの保持構造が有する欠点を説明する図。

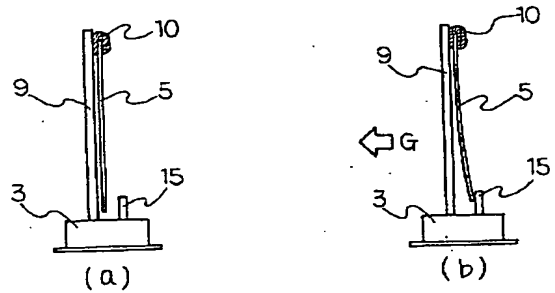
##### 【符号の説明】

- 3・・・ステム
- 5・・・水晶素板
- 6・・・電極パッド
- 7・・・アース電極パッド
- 9・・・板状サポート
- 10・・・導電性接着剤
- 11、12・・・リード端子
- 13、14・・・ワイヤ
- 15・・・ストッパー

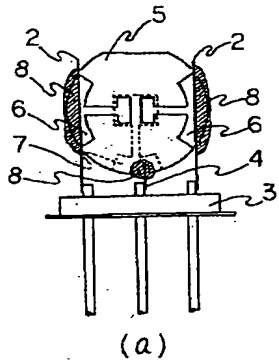
【図1】



【図2】



【図3】



【図4】

